



Note on rare snake eels (Anguilliformes: Ophichthidae) and additional data on three *Neenchelys* recently described from Taiwan

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Abstract

Three rare snake eel species, *Allips concolor* McCosker, 1972, *Neenchelys daedalus* McCosker, 1982, and *Apterichtus moseri* (Jordan & Snyder, 1901), were newly collected from Taiwan. The distribution ranges of the first two species are now extended to the South China Sea off southern Taiwan and that of the third is extended southward to off northwestern Taiwan. Supplemental data for three recently described species, *Neenchelys diaphora*, *N. gracilis* and *N. similis*, from Taiwan are provided.

Key words: taxonomy, *Apterichtus moseri*, *Allips concolor*, *Neenchelys daedalus*, new record, Taiwan

Introduction

Ho *et al.* (2015a, b) provided a revised list of all known eel species in Taiwan (orders Anguilliformes and Saccopharyngiformes) which comprised 14 families, 75 genera and 207 species. Among them, the snake eel family Ophichthidae was represented by 23 genera and 60 species. We continue studying the eel diversity of Taiwan, and as a result, more than 30 species were found new to Taiwan, many of them are undescribed. Ho (2016) reported two specimens of *Apterichtus hatookai* newly added to the eel fauna of Taiwan.

Among the *Neenchelys* species, *N. similis* was described based on the types collected from Taiwan and Japan. *Neenchelys pelagica* and *N. diaphora* were each based on three specimens and *N. gracilis* was based on the solo holotype; all were collected from southwestern Taiwan. *Neenchelys daedalus* McCosker, 1982 was described from two type specimens and 11 non-types. The latter were recognized as misidentifications of *N. similis* by Ho *et al.* (2013, 2015a), thus the two types became the only known specimens.

While preparing the new volume for the Taiwanese eels (Ho *et al.*, 2018), we collected two specimens of *N. daedalus*, two additional specimens of *N. gracilis*, five of *N. diaphora* and one of *N. similis* from southwestern Taiwan. The first represents the first record in Taiwan and supplemental data for those species are provided and their diagnoses are revised.

Another new record is a specimen of *Allips concolor* McCosker, 1972, found from bycatch of a bottom trawl in southwestern Taiwan. The species was described from a single specimen from the coast of Andaman Sea and later a record from Northern Territory, Australia (McCosker *et al.* 2006). Our specimen represents the first record from Taiwan and the South China Sea.

Although there were specimens of *Apterichtus moseri* (Jordan & Snyder, 1901) deposited in ASIZP collection, they were found to be misidentifications of *Lamnostoma mindora* (Hibino, pers. data). In the revision of *Apterichtus*, McCosker & Hibino (2015) reported five specimens collected from Japan. A specimen collected from northeastern Taiwan represents the first reliable record of this species in Taiwan.

The purposes of this study are to document three rare species newly collected from Taiwan and to provide additional data for of three rare Taiwanese species of *Neenchelys*.

Methods and materials

Methods for taking measurements and counts and terminology followed McCosker (1977), as explained in Ho *et al.* (2013). Data for comparison were taken from McCosker (1972, 1982), Ho *et al.* (2013), McCosker & Hibino (2015), and Ho & Loh (2015). Specimens used in this study are all deposited in the Pisces Collection, the National Museum of Marine Biology & Aquarium, Taiwan.

Family Ophichthidae

Allips concolor McCosker, 1972

Figures 1–2; Table 1

Allips concolor McCosker, 1972: 117 (type locality: mouth of Pakehan River, north of Ban Parknam Ranong, 10°57'42"N, 98°35'18"E, Goh Phi, Ranong Province, Thailand). McCosker *et al.*, 2006:265 (listed).

Specimen examined. NMMB-P27884, 392 mm TL, off Dong-gang fishing port, Pingtung, southwestern Taiwan, South China Sea, 9 Sep. 2016, coll. H.-C. Ho.

Diagnosis. Body extremely elongate, body depth 75–81 times in TL; trunk very long, longer than tail; tail length 2.4–2.5 in TL. Head markedly rugose, with numerous grooves on surface; snout blunt; eyes small, 2.9–4.2% of HL; dorsal-fin origin well behind level of gill opening; pectoral fins minute; and dorsal and anal fins received in deep groove. Vertebral formula 21-104-180 (20-96-174 in holotype) (McCosker, 1972; this study).

Description of NMMB-P27884. Counts and measurements are generally shown in Table 1.

Body extremely elongate, cylindrical; trunk remarkably long, longer than tail. Head short; head and nape heavily covered by waxy mucosa; snout rounded; a distinct groove ventrally on snout, made by thick lips; anterior nostrils tubular, located anteroventrally on snout, angling 30° anteriorly; posterior nostrils a simple pore, located within mouth, covered by a narrow flap with a broad base; a single barbel between anterior and posterior nostrils; eyes small, rudimentary, covered by transparent skin; lips smooth except barbel, without small papillae; mouth short, rictus behind posterior; eye diameter less than length of snout; lower jaw short, its anterior tip posterior to base of anterior nostril.

Brachial basket convex, supported by 27 branchiostegal rays (Fig. 2A), its surface with numerous distinct longitudinal grooves (Figs. 2B, 2C); gill opening moderate in size, weakly contracted, located ventrolaterally.

Head pores small but well developed (Fig. 2C), indistinct because of the heavy waxy mucosa; ethmoid pore absent; three supraorbital pores; two infraorbital pores along upper lip, and two pores on postorbital; four mandibular pores and two preopercular pores; a single interorbital (frontal) and temporal pore present; lateral-line canal complete; its pores developed but small and indistinct with waxy mucosa; eight pores anterior to level of gill opening and 105 anterior to anus.

Teeth small, pointed, weakly recurved posteriorly (Fig. 2D); teeth on maxilla uniserial; teeth on vomer biserial anteriorly and uniserial posteriorly; three intermaxillary teeth arranged in a triangular shape; teeth on dentary mostly uniserial with one pair of inner small teeth anteriorly.

Dorsal and anal fins extremely low, almost buried in a groove; dorsal-fin origin well behind level of gill opening by more than head length; caudal fin absent; pectoral fin small, oblong shaped, along upper corner of gill opening.

Coloration. When fresh, dorsal half of body yellowish brown with numerous but scattered chromatophores; ventral half creamy white, without other pigment; all fin white. When preserved, body whitish brown, darker dorsally with numerous chromatophores; dorsally on head and tip of lower jaw grayish brown with numerous small melanophores, gill basket without melanophores; dorsal, anal, and pectoral fins mostly white, end of anal fin weakly obscured.

Distribution. Known from Andaman Sea, northern South China Sea off Taiwan and northern Australia off Northern Territory. Our specimen was collected from relatively shallow area, about 100 meter depth based on the bycatch.

Remarks. The present specimen can be easily identified *A. concolor* by its characteristic elongate body and long trunk, small eyes, position of dorsal-fin well behind a level of gill opening, extremely short pectoral fins, and

states of dorsal and anal fins which are received in deep groove. The differences of all morphological characters including proportional and countable characters are unremarkable except the number of branchiostegal rays. The present specimen has numerous rays than those of the holotype (27 vs. 21). The original description might not include all rays because some rays may have been decalcified when preserved in formaldehyde.

Allips concolor was originally described as a new monotypic genus by McCosker (1972), based on a single specimen collected from the mouth of the Pakehan River, north of Ban Parknam Ranong, Thailand of Andaman Sea. McCosker *et al.* (2006) reported the species based on three specimens collected from off Northern Territory (CAS 235270). However, few data were provided. The present specimen from Taiwan is the first record from the South China Sea, as well as the northwestern Pacific Ocean. It is possible that *A. concolor* is more widespread in the Indo-west Pacific Ocean.

TABLE 1. Morphometric and meristic data of *Allips concolor* and *Apterichtus moseri*.

	<i>Allips concolor</i>		<i>Apterichtus moseri</i>	
	NMMB-P27884	Holotype	NMMB-P26648	Japan
Total length (mm)	392	375	509	245–498 (<i>n</i> =5)
% SL				
Head length	5.2	5.6	5.7	5.5–7.0
Predorsal length	10.9	12.8	—	—
Trunk length	53.8	54.7	40.5	41.7–45.5
Preanal length	58.9	60.3	46.2	47.2–51.8
Tail length	41.1	39.7	53.8	48.5–52.8
% HL				
Pectoral-fin length	7.1	*	—	—
Snout length	12.4	14.3	17.6	15.6–18.2
Eye diameter	4.2	2.9	6.9	6.3–8.0
Upper jaw length	25.6	24.8	39.7	38.4–44.9
Interorbital width	8.7	12.4	8.3	4.2–6.6
Postorbital length	83.3	*	73.8	71.6–76.8
Gill opening height	8.5	8.1	15.5	7.5–13.7
Depth at head	26.3	26.7	29.7	24.5–30.4
Depth as anus	23.5	23.8	26.9	19.3–25.9
Width at anus	24.1	*	25.5	22.9–24.9
Meristics				
Pre-pectoral pores	8	*	—	—
Pre-dorsal pores	21	*	—	—
Pre-anal pores	105	*	64	67–70
Total pores	*	*	139	140 (<i>n</i> =1)
Supraorbital pores	3	3	1+4	1+4
Infraorbital pores	4	4	4+3	4+3
Frontal pore	1	1	1	1
Mandibular pores	4	4	5	5
Preopercular pores	2	2	3	3
Supertemporal pores	1	1	5	5 or 6
Predorsal vertebrae	21	20	—	—
Preanal vertebrae	104	96	63	65–67 (<i>n</i> =3)
Total vertebrae	180	174	144	141–145 (<i>n</i> =3)

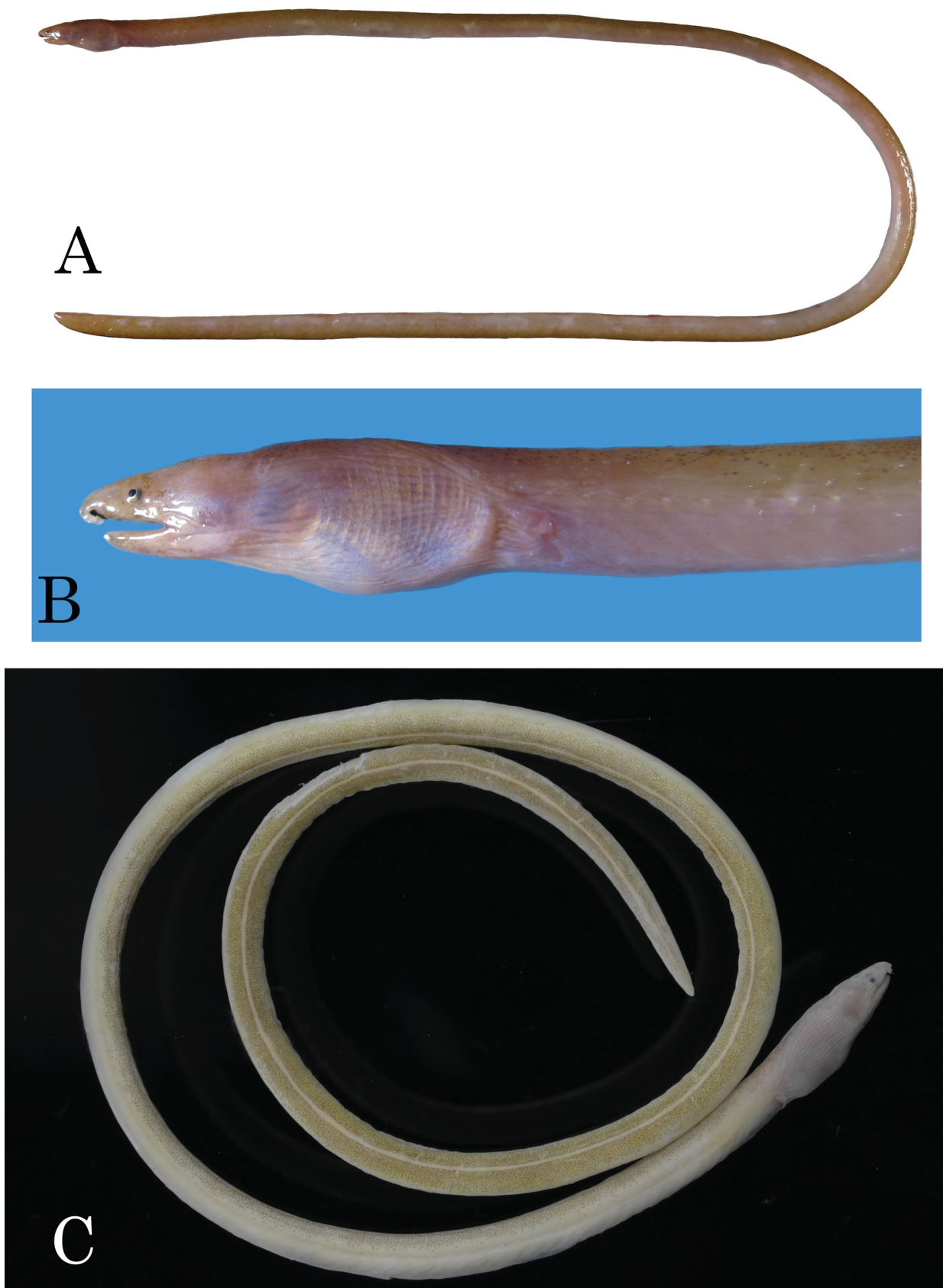


FIGURE 1. *Allips concolor* McCosker, 1972, NMMB-P27884, 392 mm TL. A–B. fresh condition. C. preserved condition.

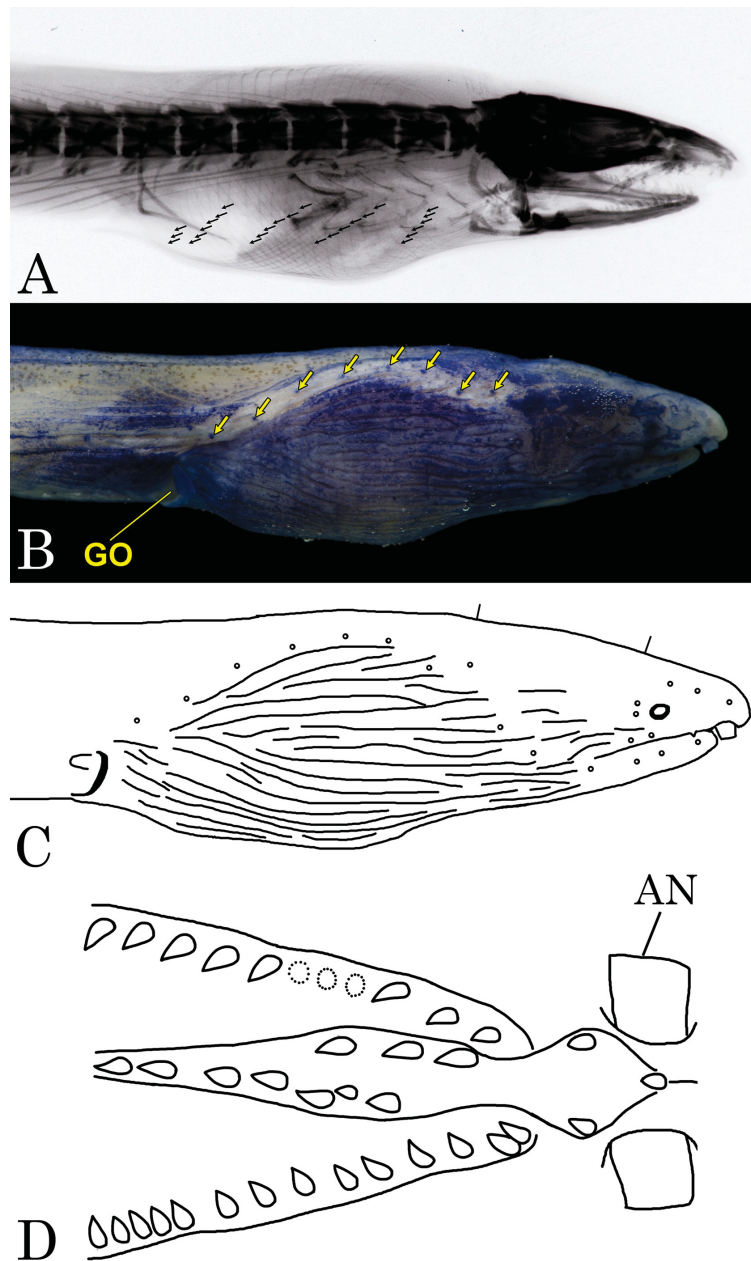


FIGURE 2. *Allips concolor* McCosker, 1972, NMMB-P27884, 392 mm TL. A. radiography of head, arrows point the branchiostegal rays (27 in total). B. closed view of head, after mucosa removed and stained by cyanin-blue. Arrows pointed lateral-line pores. B. head pores. D. upper jaw teeth, anterior to right. GO= gill opening. AN=anterior nostril.

McCosker (per. comm., 2018) provided data of holotype and two additional specimens from Australia, the later have vertebral formula 24-93-170 and 21-92-168, respectively. Compared to these specimens, ours has somewhat more preanal and total vertebrae. We provisionally recognize our specimen as *Allips concolor* and call attention that this may be a different species.

McCosker (1972) described the lateral-line pores of the holotype as impossible to discern because of their reduced state and an overlying waxy precipitate. Based on our removal of the waxy musoca the lateral-line pores appear to be developed similarly to other related ophichthids (Fig. 2B). In addition, the lateral-line canal of this species is well developed except for a short distance (8.7 mm) at the tail end of the fish.

Allips concolor has considerable waxy musoca for an ophichthid. The strong musoca and elongate body is similar to that of the Moringuidae, and may be an adaptation for muddy estuary environments.

Apterichtus moseri (Jordan & Snyder, 1901)

Figure 3; Table 1

Sphagebranchus moseri Jordan & Snyder, 1901:864, fig. 14 (type locality Suruga Bay, off Numazu, Shizuoka Prefecture, Japan, holotype USNM 49729).

Apterichtus moseri: Smith, 1994:36. McCosker & Hibino, 2015:22 (review).

Specimens examined. NMMB-P26648, 509 mm TL, off Nan-fang-ao fishing port, Suao, Yilan, northeastern Taiwan, bottom trawl, 29 Jun. 2017, coll. J.-F. Huang. Non-types from Japan. Five specimen listed in McCosker & Hibino (2015). SFNR 11043, 420 mm TL, northern East China Sea.

Diagnosis. A species of *Apterichtus* with a slender and cylindrical body, its depth 53–74 times in TL; anus at or slightly anterior to mid-trunk; 3 preopercular pores and 5 (rarely 6) pores in supratemporal canal; anterior margin of orbit above or slightly behind tip of lower jaw; head 14–18 in TL, trunk 2.2–2.5 in TL; tail 1.9–2.1 in TL. Total vertebrae 141–145, MVF 66–143. Anterior third of body grayish; face, cheek and gill openings with white patches; posterior two-thirds uniformly tan; whitish pores surrounded by dark brown or dark orange blotches on preopercular and supratemporal canals (McCosker & Hibino, 2015; present study).

Description of NMMB-P26648. Body very elongate, its depth at anus 65 times in TL; somewhat cylindrical with tail gradually compressed posteriorly; depth of body relatively uniform, tapering gradually to tail tip; depth of head deeper than that of body. Tail slender, anus slightly anterior to midpoint of the fish. All fins absent.

Head relatively small, its length 17.6 times in TL; dense small papillae on surfaces of snout, lips and lower jaw; snout very pointed anteriorly, flattened ventrally; tip of snout projecting far beyond lower jaw, its length 5.7 times in HL; dorsal surface of snout convex, gradually narrower anteriorly. Anterior nostril tubular with the opening directed downward; posterior nostril on upper lip, beneath anterior margin of eye, the opening directed ventrally, appearing in lateral aspect as a diagonal slit.

Lower jaw included, its tip slightly before anterior margin of eye, far behind anterior nostril. Rictus extends to about two eye diameters behind a vertical through posterior margin of pigmented eyeball (posterior margin of eye about above midpoint of rictus). Tongue not free, well attached to mouth floor. Gill openings narrow and slightly oblique, situated at ventral side of head, their anterior ends closer to each other than posterior ends.

Head pores small (Fig. 3C). Supraorbital pores 5, first pore at ventral side of snout, last pore at anterior half of interorbital space; infraorbital pores 6, 2 pores between anterior and posterior nostrils, 3 along the upper jaw behind posterior nostril, and 2 behind eye. Mandibular pores 5; preopercular pores 3; supratemporal pores 5; 1 frontal pore.

Teeth slender, pointed, tips directed posteriorly (Fig. 3D). Intermaxillary teeth 6, in 2 oblique row, well separated from that of vomer; vomerine teeth with single row of 3 teeth; maxillary and dentary teeth uniserial, each with 12–14 teeth.

Lateral line nearly complete, pores small and inconspicuous, the canal extending to nearly tip of rear end. Cephalic lateral line pores 4 (plus 2 pores above gill opening), preanal pores 64, and total pores 139.

Preanal vertebrae 63, and total vertebrae 144.

Coloration. When fresh, anterior third mostly yellowish gray on purplish red background, posterior two-thirds purplish red with some light gray patches. When preserved, anterior third of body grayish, face and cheek with large irregular areas; posterior two-thirds yellowish gray.

Remarks. The 5 supratemporal pores, 3 preopercular pores and 144 total vertebrae will narrow down our specimen to two candidate species in the key (item 16) provided by McCosker & Hibino (2015): *A. moseri* and *A. klazingai*. Our specimen has 63 preanal vertebrae and tail 1.9 times in TL, both are somehow in-between these two species. However, the specimen has the rictus slightly before the eye and a smaller head (17.6 times in TL) which will refer our specimen to *A. moseri*.

As shown in Table 2, our specimen fit to the Japanese species well, except for there are only 3 teeth on vomer (Fig. 3D) and coloration is slightly vary. YH examined one more specimen collected from East China Sea (SFNR 11043) which also has 3 vomerine teeth.

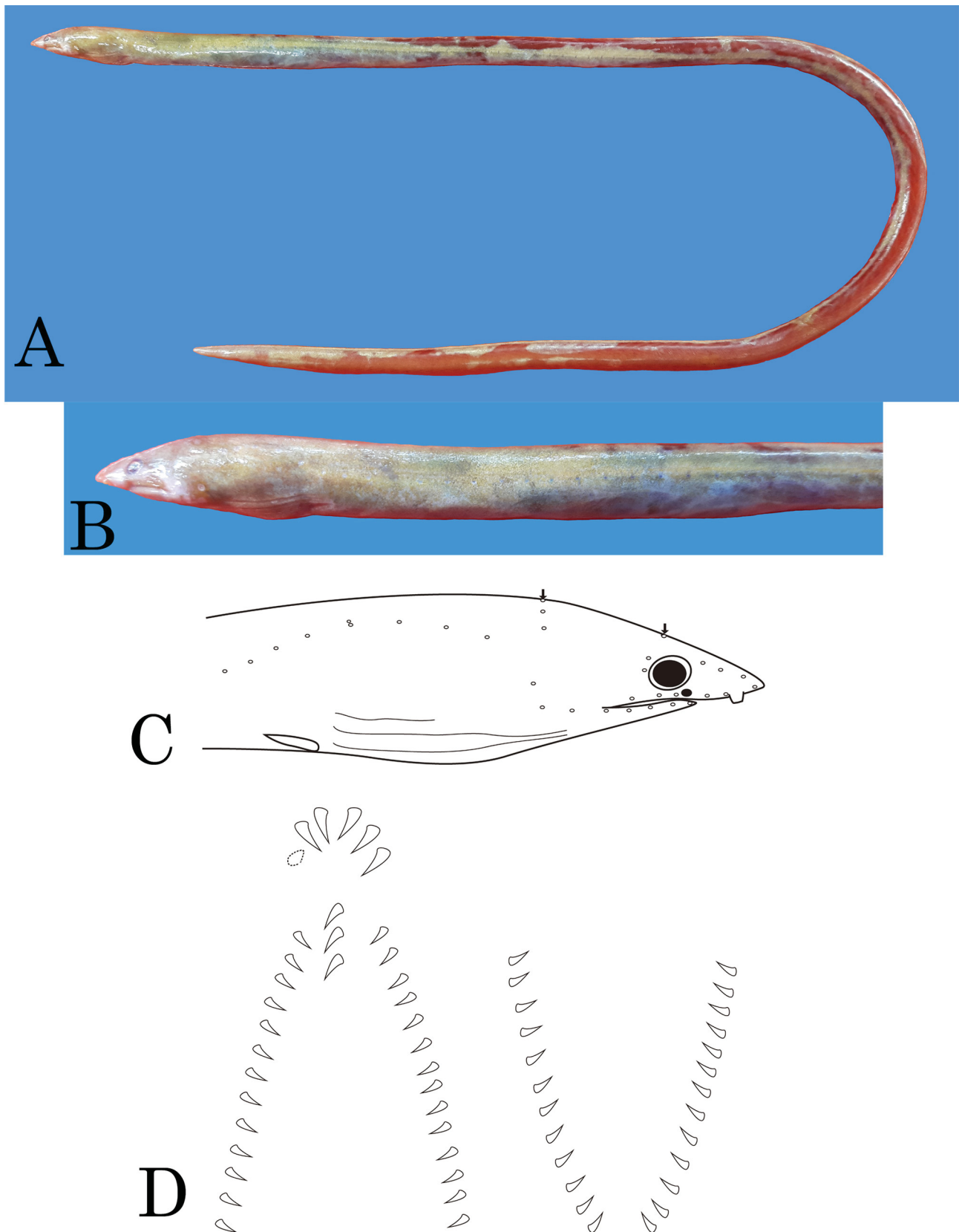


FIGURE 3. *Apterichtus moseri* (Jordan & Snyder, 1901), NMMB-P26648, 509 mm TL. A. lateral view. B. close view of head. C. head pores, arrows indicate the median ST pore (left) and frontal pore (right). D. teeth on upper jaw (left) and lower jaw (right).

TABLE 2. Morphometric and meristic data of *Neenchelys daedalus* and *N. diaphora*.

	<i>N. daedalus</i>			<i>N. diaphora</i>	
	NMMB-P26828	NMMB-P27328	Types	Non-types	Types
Total length (mm)	306	392	273–342 (n=2)	296–502 (n=5)	264–478 (n=3)
% SL					
Head length	6.8	6.6	6.9–7.8	9.0–10.1	9.3–10.1
Predorsal length	15.1	14.5	14.5–15.4	21.2–22.7	21.9–22.8
Trunk length	19.2	20.7	19.0–19.6	22.7–26.8	23.8–26.3
Preanal length	26.0	27.3	25.9–27.4	32.8–35.8	33.7–35.6
Tail length	74.0	72.7	72.6–74.1	64.2–67.2	64.4–66.3
% Trunk length					
Gill opening to DFO	43.4	38.3	38.5–40.0	48.9–51.3	49.2–51.3
% HL					
Pectoral-fin length	21.3	23.3	22.1–23.4	17.4–24.2	25.0–26.8
Snout length	17.9	15.8	16.6–17.8	16.8–20.3	19.0–19.4
Eye diameter	6.8	6.8	5.1–5.6	6.1–7.2	6.1–6.8
Upper jaw length	30.0	26.9	24.3–26.4	29.3–31.8	29.3–31.3
Interorbital width	12.6	10.7	8.4–8.7	11.7–14.7	13.3–14.6
Postorbital length	79.7	83.8	*	72.5–79.5	72.2–79.0
Gill opening height	4.8	6.4	*	4.5–6.1	8.8–12.6
Depth at head	25.6	25.4	*	28.4–34.9	30.3–35.7
Depth as anus	29.5	28.1	27.6–27.7	30.2–35.3	32.6–50.0
Width at anus	23.2	20.4	16.4–17.9	23.5–27.5	27.2–37.5
Meristics					
Pre-pectoral pores	13; 14	14; 14	14	13–16	13–15
Pre-dorsal pores	34; 35	33; 33	*	34–38	35–38
Pre-anal pores	60; 61	61; 61	61	55–59	56–59
Total pores	ca. 190	ca. 201	*	137–144	*
Supraorbital pores	1+4	1+4	1+4	1+4	1+4
Infraorbital pores	5+1	5+1	5+1	4+2	4+2
Frontal pore	1	0	1	1	1
Mandibular pores	6;6	6;6	5;5	5–7	6
Preopercular pores	2	2	2	2	2
Supertempal pores	3	3	3	3	3
Predorsal vertebrae	32	31	31	31–35	34–35
Preanal vertebrae	57	59	58–59	51–57	54–55
Total vertebrae	233	238	225–235	177–181	177–181

***Neenchelys daedalus* McCosker, 1982**

Figure 4; Table 2

Neenchelys daedalus McCosker, 1982:63, figs. 4–5 (type locality: Astrolabe Bay, south of Madang, Papua New Guinea, 5°24'S, 14°52.5'E). Hibino *et al.*, 2012:345 (in part). Ho *et al.*, 2013:7. Tashiro *et al.*, 2015:5. Ho & Loh 2015:54. Hibino *et al.*, 2015:57 (in Key).

Material examined. NMMB-P26828, 306 mm TL, off Dong-gang fishing port, Pingtung, southwest Taiwan,

South China Sea, 6 Feb. 2017, coll. J.-F. Huang. NMMB-P27328, 392 mm TL, off Dong-gang fishing port, Pingtung, southwest Taiwan, South China Sea, 13 Oct. 2017, coll. H.-C. Ho.

Diagnosis. A species of *Neenchelys* with the following combination of characters: body elongate and relatively compressed, its depth 46–54 times in TL; origin of dorsal fin at about midtrunk, 1.0–1.2 times HL behind gill opening; predorsal length 6.5–6.9 in TL; head 13–15 in TL, trunk 4.8–5.3 in TL; tail 1.3–1.8 in TL; pectoral fin elongate, nearly as long as upper jaw; an enlarged blunt flap on posterior-dorsal margin of anterior nostril. Total vertebrae 225–238, MVF 31–58–233. Mandibular pores 5–6. Body coloration in isopropyl alcohol uniformly tan, except belly which is dark brown to black; fins colorless except darker posterior end. (McCosker, 1982; present study)

Description of Taiwanese specimens. The following data are given for 306 mm specimen parenthetically followed by those of the 392 mm specimen.

Body very elongate, body depth at anus 50 (54) times in TL; somewhat cylindrical with tail gradually compressed posteriorly; depth of body relatively uniform, tapering gradually to tail tip; depth of head subequal to that of body. Tail slender, anus at anterior 1/4 of total length. Dorsal and anal fins low and fleshy, continuous with a small but distinct rayed caudal fin; origin of dorsal fin slightly before mid-point of trunk. Pectoral fin relatively well developed, broad at base and pointed posteriorly.

Head profile terete, relatively small, its length 14.8 (15.1) times in TL; scattered small papillae on surfaces of anterior portions of snout, lips and lower jaw; snout acute anteriorly, tip of snout projecting well beyond lower jaw, its length 5.6 (6.3) times in HL; dorsal surface of snout broad and tumid, housing an extensive nasal organ on either side. Anterior nostril tubular with an enlarged blunt flap on posterior-dorsal margin, the opening directed anteroventrally. Posterior nostril in front of lower margin of eye, opening directed ventrally, appearing in lateral aspect as a diagonal slit, the posterior end of which is highest. Behind and below nostril and parallel to it is a groove that is longer than nasal slit.

Lower jaw included, its tip reaching a line between anterior margins of anterior nostrils. Angle of gape about one eye diameter behind a vertical through posterior margin of pigmented eyeball. Tongue not free, well attached to mouth floor. Gill opening a narrow vertical slit, situated at anteroventral corner of pectoral fin base.

Head pores small (Fig. 4C, in part). Supraorbital pores 5 (5), first pore at ventral side of tip of snout, last pore at anterior-dorsal corner of eye; infraorbital pores 6 (6), 2 pores between anterior and posterior nostrils, 2 beneath and 2 behind eye. Mandibular pores 6 (6); preopercular pores 2 (2); supratemporal pores 3 (3; if 2 side pores counted as first pore of lateral line); 1 (0) frontal pore; no adnasal pore.

Teeth slender, pointed, tips directed posteriorly (Fig. 4D). Intermaxillary teeth 2 (2), well separated from that of vomer; vomerine teeth uniserial, terminating posteriorly at about level of posterior margin of eye; maxillary uniserial, originating between second and third vomerine tooth, with 9–10 (10–11) teeth, terminating posteriorly at gape; dentary with 16 (25–29) uniserial teeth, its end terminating at opposite maxillary tooth row.

Lateral line incomplete, pores small and inconspicuous, the canal extending to about one HL before the tail tip. Cephalic lateral-line pores 13–14 (14), predorsal pores 34–35 (33), preanal pores 60–61 (61), and total pores ca. 190 (ca. 200).

Predorsal vertebrae 32 (31), preanal vertebrae 57 (59), and total vertebrae 233 (238).

Coloration. When fresh uniformly brownish gray with posterior end of dorsal and anal fin margins edged black; in preservative gray to light brown, with posterior end of dorsal and anal fins edged black.

Remarks. The species was originally described based on 2 specimens collected from Papua New Guinea. Although there is one additional record from Japan, it was proved to be a misidentification (Ho *et al.*, 2013, 2015). Thus our specimens represent the third specimens of this species and also the first record of northwestern Pacific Ocean.

Table 2 shows the morphometric and meristic data of two Taiwanese specimens compared to these of two types. The morphometric proportions are mostly overlapped, except for these mentioned below. In Taiwanese specimens, the eye diameter is slightly larger (6.8% vs. 5.1–5.6% HL), the interorbital width is clearly broader (10.7–12.6% vs. 8.4–8.7% HL), the rictus is slightly longer (26.9–30.0% vs. 24.3–26.4% HL), and the body is slightly deeper and wider. The numbers of head and lateral-line pores are quite consistent, except for 6 mandibular pores in a Taiwanese specimen, whereas the types have only 5. It is notable that the types have a single frontal pore, whereas one of our specimens has one and the rest have none. YH examined the CAS paratype and found its eye diameter 7.2% HL and rictus 31.3% HL. Moreover, the CAS paratype has small papillae on its snout, lips and anterior portion of its lower jaw, similar to that of *N. similis*, but quite scattered in arrangement.

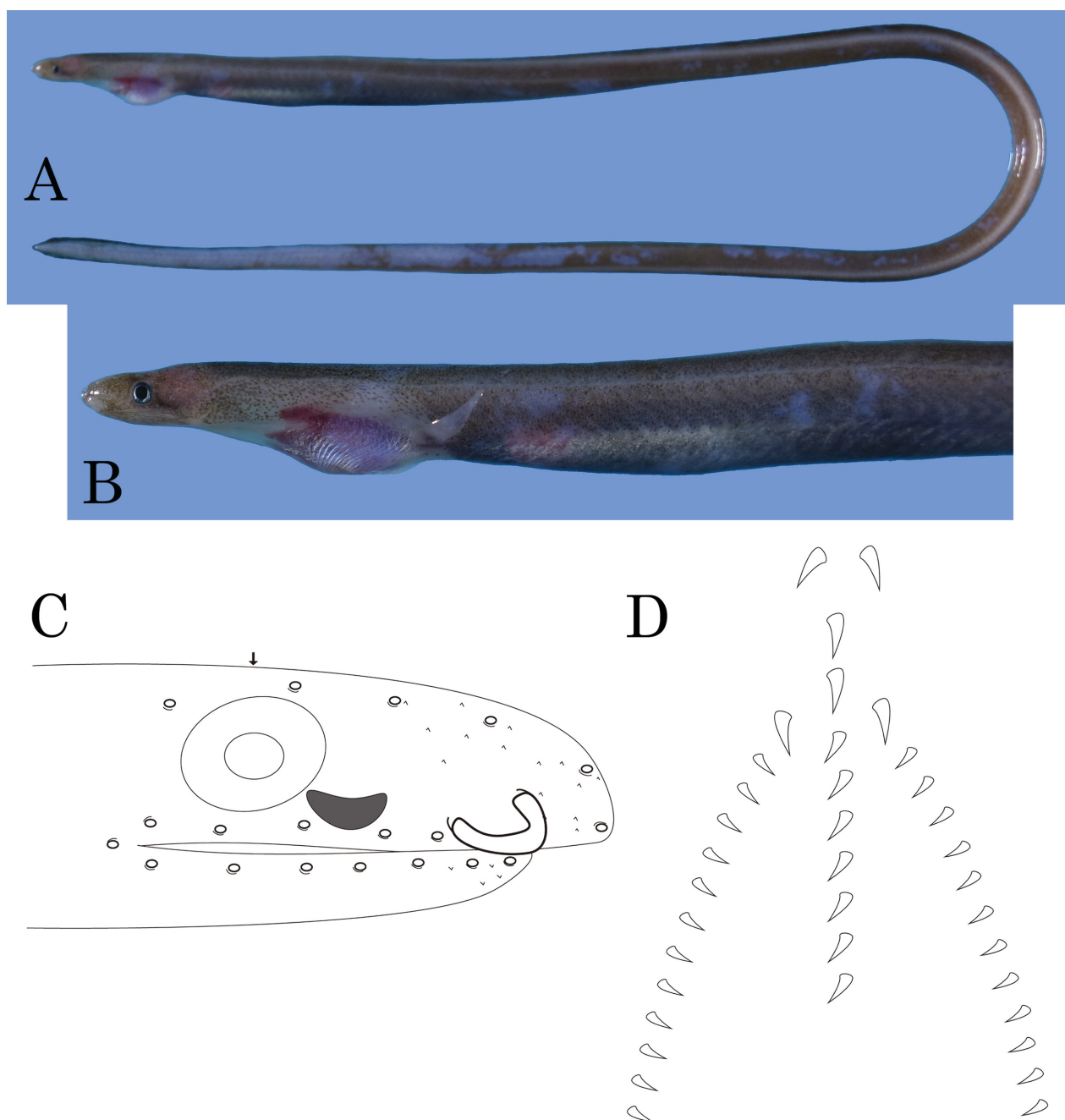


FIGURE 4. *Neeenchelys daedalus* McCosker, 1982. A, B. NMMB-P26828, 306 mm TL, lateral view. C, D. NMMB-P27328, 392 mm TL. C. anterior portion of head, arrow indicates frontal pore. D. upper jaw teeth.

Our specimen has the vertebrae formula 32-57-233 (31-59-238) which is close to that of the type series.

The arrangement and number of teeth is nearly identical to that of the paratype (Ho *et al.* 2013: figs. 3C, D), except there are only two intermaxillary teeth. Both of our specimens have 6 pores on each side of the mandible, instead of 5 in the type series. These two differences may be attributable to individual variation.

It is also notable that the holotype (342 mm TL) and paratype (272 mm TL) of *N. daedalus* are females with mature or near-mature gonads (holotype has eggs approximately 1 mm in diameter), whereas *N. similis* matures at more than 600 mm TL. This may indicate that *N. daedalus* is a smaller species.

Neeenchelys diaphora Ho, McCosker & Smith, 2015

Figure 5; Table 2

Neeenchelys diaphora Ho, McCosker & Smith, 2015a:49 (type locality: Dong-gang Fishing Port, SW Taiwan, northern South China Sea; first appeared in Ho *et al.*, 2013). Ho *et al.*, 2015b:8. Ho *et al.*, 2015c:170. Hibino *et al.*, 2015:57 (in Key).



FIGURE 5. *Neeenchelys diaphora* Ho, McCosker & Smith, 2015, NMMB-P25962, 288 mm TL. A. Lateral view. B. Close view of head.

Specimens examined. Three types listed in Ho *et al.* (2015). Non-types. NMMB-P18098, 502 mm TL, Dong-gang, Pingtung, 31 Dec. 2012. NMMB-P25251, 296 mm TL, Dong-gang, Pingtung, 2 Apr. 2015. NMMB-P25961, 327 mm TL, NMMB-P25962, 288 mm TL, Dong-gang, Pingtung, 27 Feb. 2017. NMMB-P26219, 354 mm TL, Dong-gang, Pingtung, 23 Jun. 2017.

Diagnosis. A species of *Neeenchelys* with the following combination of characters body cylindrical, body depth at gill opening 2.0–3.3 times in HL, 28–36 in TL; dorsal-fin origin at midpoint of trunk, 1.1–1.5 times in HL behind gill opening; predorsal length 4.4–4.7 in TL; HL 9.9–11.2 in TL; tail 1.5–1.6 in TL; pectoral fin well developed and relatively large, 3.7–5.7 in HL; total vertebrae 177–186; MVF 34–54–179. Cephalic lateral-line pores 13–15; predorsal pores 34–38; preanal pores 55–59.

Remarks. Data for the newly collected specimens from the same region as the type locality are provided in Table 1. All data agree with (except some may be slightly outside) the range of the types series. The diagnosis is modified according to the newly collected specimens. It is notable that Ho *et al.* (2013, 2015) separated their species from its congeners by the relatively large gill opening (8.8–12.6% HL), however, the newly collected specimens have small gill openings (4.5–6.1% HL). Hence, this character may not be consistent.

Neenchelys gracilis Ho & Loh, 2015

Figure 6; Table 3

Neenchelys gracilis Ho & Loh, 2015:52, figs. 1–2 (type locality: off Dong-gang, Pingtung, Taiwan, China Sea, depth ca. 400 meters). Ho *et al.*, 2015b:8. Ho *et al.*, 2015c:170. Hibino *et al.*, 2015:57 (in Key).

Specimens examined. Holotype. NMMB-P22195, 429 mm TL, off Dong-gang, Pingtung, 1 Nov. 2014. Non-types. NMMB-P26438, 393 mm TL, Dong-gang, Pingtung, 20 Jun. 2017. NMMB-P27447, 500 mm TL, Dong-gang, Pingtung, 30 Aug. 2017.



FIGURE 6. *Neenchelys gracilis* Ho & Loh, 2015. NMMB-P26438, 393 mm TL. A. lateral view. B. close view of head.

Diagnosis. A species of *Neenchelys* with the following combination of characters: pectoral fin minute, a tiny flap at upper corner of gill opening; many cirri on rim of anterior nostril; body cylindrical, body depth at gill opening 4.4–6.5 times of HL, 66–96 in TL; dorsal-fin origin at anterior third of trunk, 1.7–1.9 times in HL behind gill opening; predorsal length 5.1–6.0 in TL; head relatively short, 14.7–16.1 in TL; trunk 3.0–3.1 in TL; tail long, 1.6–1.7 in TL. Total vertebrae 197–204; VF 32–73–200. Cephalic lateral-line pores 11–12; predorsal pores 32–37; and preanal pores 71–78. Body uniformly deep gray or dark brown.

Remarks. Although not overlapping with most values of the holotype, the two newly collected specimens show similar proportions with the holotype. The head length, predorsal length, preanal length, trunk length and snout length are slightly larger than these of the holotype (Table 3). The meristic values are more variable, there are 30 predorsal vertebrae in the holotype, versus 35 (393 mm) and 30 (500 mm) in two other specimens; 78 preanal vertebrae, versus 69 and 73, respectively; 200 total vertebrae, versus 197 and 204, respectively. The head and lateral-line pores also varies, there are 5 mandibular pores in the holotype, versus 6 in two other specimens; 33 predorsal pores, versus 37 and 32, respectively; 78 preanal pores, versus 71 and 75, respectively. All these differences are considered as individual variation and the diagnosis of the species is revised accordingly. It also notable that one specimen (393 mm) has a frontal pore, whereas the other two have none. Same situation also found in our *N. daedalus* and the presence of absence of frontal pore is variable in these two species, a unique condition within the genus.

TABLE 3. Morphometric and meristic data of *N. gracilis* and *N. similis*.

	<i>N. gracilis</i>			<i>N. similis</i>	
	NMMB-P26438	NMMB-P27447	Holotype	NMMB-P27883	Types
Total length (mm)	393	500	429	409	580–756
% SL					
Head length	6.7	6.8	6.2	7.2	6.1–6.6
Predorsal length	19.7	16.9	16.6	14.1	12.9–14.8
Trunk length	33.0	33.2	32.3	19.9	20.7–21.8
Preanal length	39.7	40.0	38.5	27.1	26.7–28.3
Tail length	60.3	60.0	61.5	72.9	72.4–72.9
% Trunk length					
Gill opening to DFO	39.3	30.5	32.1	34.7	31.6–38.6
% HL					
Pectoral-fin length	–	–	–	24.9	24.0–26.0
Snout length	18.4	18.3	15.8	17.3	15.6–17.5
Eye diameter	5.4	4.1	5.3	7.3	4.9–5.9
Upper jaw length	32.5	25.4	32.8	30.0	27.2–32.8
Interorbital width	9.5	8.7	9.8	9.2	6.3–9.2
Postorbital length	76.0	80.2	81.9	75.3	77.2–81.9
Gill opening height	4.4	3.6	3.8	5.4	5.2–8.2
Depth at head	22.8	15.3	21.1	20.0	29.7–34.9
Depth as anus	24.3	18.6	21.1	22.4	32.9–35.4
Width at anus	17.9	14.5	18.5	17.3	22.9–28.0
Meristics					
Pre-pectoral pores	11	12	11	16	15–16
Pre-dorsal pores	37	32	33	36	35–37
Pre-anal pores	71	75	78	71	70–71
Total pores	ca. 172	175	169	191;196	*
Supraorbital pores	1+4	1+4	1+4	1+4	1+4
Infraorbital pores	5+1	5+1	5+1	5+1	5+1
Frontal pore	1	0	0	1	1
Mandibular pores	6;6	6;6	5;5	7;7	7
Preopercular pores	2	2	2	2	2
Supertemporal pores	3	3	3	3	3
Predorsal vertebrae	35	30	30	34	32–36
Preanal vertebrae	69	73	78	69	68–70
Total vertebrae	197	204	200	262	260–265

***Neenchelys similis* Ho, McCosker & Smith, 2015**

Figure 7; Table 3

Neenchelys similis Ho, McCosker & Smith, 2015a:50 (type locality: Daxi Fishing Port, Ilan, NE Taiwan). Ho & Loh, 2015:54.
 Ho *et al.*, 2015b:8. Ho *et al.*, 2015c:170. Hibino *et al.*, 2015:60.

Specimen examined. The type series listed in Ho *et al.* (2015). Non-type. NMMB-P27883, 409 mm TL, off Dong-gang fishing port, Pingtung, bottom trawl, 6 Dec. 2017.

Diagnosis. A species of *Neenchelys* with the following combination of characters: body extremely elongate and slightly compressed, its depth 2.6–5.0 times in HL, 43–69 in TL; dorsal fin origin at anterior 1/3 of trunk, 1.0–1.3 times in HL behind gill opening; predorsal length 6.8–7.7 in TL; head relatively short, 13.9–16.3 in TL; trunk 4.6–5.0 in TL; tail extremely long, 1.4 in TL; pectoral fin well developed, longer than snout. Total vertebrae 260–265; MVF 34–68–262. Cephalic lateral line pores 15–16; predorsal pores 35–37; preanal pores 70–71.



FIGURE 7. *Neenchelys similis* Ho, McCosker & Smith, 2015. NMMB-P27883, 409 mm TL. A. lateral view. B. close view of head.

Remarks. The original description was based on the holotype collected from northeastern Taiwan, 3 paratypes collected from Japan, and 11 non-types from Papua New Guinea and the Banda Sea.

Our specimen is smaller than the type series and some differences are observed: the head is longer (7.2%, vs. 6.1–6.6% TL), the trunk is smaller (19.9%, vs. 20.7–21.8% TL); the eye is larger (7.3%, vs. 4.9–5.9% HL); the postorbital length is smaller (75.3%, vs. 77.2–81.9% HL); the both depth and width are smaller (depth 20.0%, vs. 29.7–34.9% HL; width 22.4%, 32.9–35.4% HL). It is common that smaller specimens of *Neenchelys* tend to have a narrower body and slightly longer head. Thus, these differences are attributed to growth (Tashiro *et al.*, 2016). Other values and meristics agree well with the original description. The number of lateral-line pores were not provided in the original description due to the condition of the specimen, we counted 191 (right side) and 196 (left side) in the newly collected specimen, the last pore runs to about 4 head lengths before the caudal fin, which is much more anterior than its congeners.

Acknowledgements

We thank J. E. McCosker for providing the data of *Allips concolor* and for reviewing the manuscript; W.-C. Ma, H.-J. Chang, J.-T. Lin, R.-R. Chen (NMMBA), J. E. McCosker, M. Hoang, and D. Catania (CAS), G. Shinohara, M. Nakae (NSMT), and K. Hoshino and M. Okamoto (SNFR) for curatorial assistances. M. McGrouther and A. Hay (AMS) provided information of the holotype of *N. daedalus*. This study is supported by the National Museum of Marine Biology & Aquarium, Taiwan, the Aquatic Biology Research Fund of the California Academy of Sciences, and a Grant-in-Aid from the Japan Society for the Promotion of Science for JSPS Fellows to YH (DC2/PD: 15J02820).

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